



CALIFORNIA STATE SCIENCE FAIR 2008 PROJECT SUMMARY

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Project Title Gamma Irradiation Studies of Spinach Leaves	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals My project studied the effects of gamma irradiation on reducing bacteria levels of E.Coli-contaminated spinach leaves, extending the shelf life of non-contaminated spinach leaves, and determining any adverse effects on smell, appearance, and texture. The results could have application to commercial treatment of spinach leaves.</p> <p>Methods/Materials Organic spinach leaves from Whole Foods Market were divided into 3 groups: E.Coli contaminated group 1, non-E.Coli contaminated group 2, and sensory assessment group 3. Non-pathogenic E.Coli (0157:H7) was used to inoculate the group 1 spinach leaves. Gamma irradiation of all spinach leaf groups were conducted at Sterigenics in Tustin, California. Experiment 1: Elimination of E.Coli Bacteria E.Coli contaminated spinach leaves were irradiated with gamma rays at 4 doses (0, 0.5, 1.4, and 2 kGy). E.Coli bacteria counts were measured over 11 days to determine the effectiveness of gamma irradiation in killing off E.Coli bacteria colonies. Experiment 2: Spinach Shelf Life, Smell, Appearance, and Texture Non-contaminated spinach leaves were irradiated at the same 4 doses. Over 11 days, the appearance, smell, and texture of the leaves were recorded to determine undesirable sensory changes to the spinach leaves. Spinach shelf-life improvements were estimated by measuring the aerobic (naturally occurring) bacteria levels on the leaves as a function of gamma dose.</p> <p>Results 1. A 2 kGy gamma dose caused a 500x reduction in E.Coli levels. A 0.5 kGy gamma dose caused a 5x reduction. 2. A 2 kGy gamma dose caused a 10x reduction in Aerobic (naturally occurring) bacteria levels, thus extending shelf life, while a 0.5 kGy dose caused a 4x reduction. 3. A 2 kGy gamma dose caused the color of spinach leaves to change from dark green to pale green, a dry texture, and a less fresh smell. A 0.5 kGy dose had little change on color, texture, and smell.</p> <p>Conclusions/Discussion Gamma irradiation is effective in eliminating E.Coli bacteria from infected spinach leaves, and extending the shelf-life of non-contaminated spinach leaves. However, it can adversely affect spinach leaf smell, texture, and appearance, if the dose level is high. I found that 0.5kGy is the near-optimum level for eliminating bacteria and extending shelf-life, while retaining good sensory attributes of spinach leaves.</p>	
Summary Statement Gamma irradiation of spinach leaves can effectively eliminate bacteria, extend shelf-life, but may have an adverse effect on the smell, appearance, and texture.	
Help Received Professors Antonio Machado and John Schillinger of California State University at Northridge (CSUN) provided E.Coli bacteria for inoculation; Professor Anuradha Prakash at Chapman University critiqued the test methodology; Jeremy Bolnick of Sterigenics conducted the gamma irradiation tests.	